



Clinical Group

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## Research Article

# The outcomes of postoperative total hip arthroplasty following Western Ontario McMaster Universities Osteoarthritis Index (WOMAC): A prospective study

## Abstract

**Objectives:** Evaluation of the quality of life for patient with total hip arthroplasty surgery (THA) and whether patients with poor function before THA have the ability to recover less than those with less preoperative disability.

**Subjects and methods:** A prospective study evaluated the preoperative and 3-month postoperative health-related quality of life score of 41 patients with THA due to hip osteoarthritis (OA) and femoral head necrosis (FHN) in Hanoi Medical University Hospital from February 201 to November 2017. The study divided into 2 function groups following the median preoperative Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) physical function scores.

**Results:** Average age is 53.78± 8.95. Male/female ratio is approximately 3: 1. 87.8% patients with femoral head necrosis situation. 100% patients had good health related to quality of life. However, low function group improves more significantly than high function group. In addition, the proportion of normal number patients after 3 months of THA between low and high function group was 20.38%, and 23.53%, respectively for WOMAC physical functioning.

**Conclusion:** Total hip arthroplasty surgery significantly improves patient health and well-being. THA surgery helps patients improve significant quality of life regardless the level of physical functioning before surgery.

## Background

The rate and the number of hip replacement surgeries gradually increased in the United States. Demanding for new hips across all ages had risen; there were 89,919 of the operations in 2004-05 and 122,154 in 2014-15 in England [1]. One of the most common indications of hip replacement surgeries are arthritis, is mainly manifested by osteoarthritis and femoral head necrosis. Total hip replacement revolutionised management of elderly patients as well as young patients crippled with arthritis, with very good long-term results [2].

Joint replacement for severe osteoarthritis or femoral head necrosis of the hip is an effective treatment. Total hip replacement is the most successful and common method, which has a large rate of satisfaction after total replacement surgery and help patients return activities in their life, but a recent systematic review found that between 7% and 23% of patients report long-term pain after total hip replacement and

complications like infection, as well as reporting reoperation after performing surgery [3,4]. As a consequently, assessment the outcomes of hip replacement post- operation is very necessary.

In the past, everyone always believed that patient with lower preoperative function were more likely to get worse outcome than patient with higher preoperative function in total hip replacement [5,6]. However, in 2016, Alzahrani [7], modified and took some factors into account related to study design, including the number of surgeons, protocol, preoperative education, minimally invasive surgery techniques, postoperative rehabilitation; the result was completely different to previous studies. THA surgery helps patients with better functional outcomes and more satisfaction whether patients have a high or poor function before surgery [7]. In addition, in Vietnam we have not any studies to monitor the outcomes of total hip replacement between low function and high function groups. As a consequently, we conducted this study with the

following objectives: evaluation of the quality of life for patient with total hip replacement and whether patients with poor function before THA have the ability to recover less than those with less preoperative disability.

## Materials and methods

**Subjects:** 41 patients who were diagnosed with femoral head necrosis and hip osteoarthritis were treated by THA with minimally invasive surgery at Hanoi Medical University Hospital (HMHU), Ha Noi, Vietnam from February 2017 to November 2017.

### Study design: A prospective study

**Inclusion criteria** were all patients who could give informed consent, were 18 years old and older, underwent total hip replacement due to femoral head necrosis and hip osteoarthritis and had indicative for THA, and were operated by only one experienced surgeon.

**Exclusion criteria** included people did not give consent to participate in research, under 18 years old, are unable to answer the questionnaires, and underwent part hip replacement as well as THA without femoral head necrosis and hip osteoarthritis.

**Study instruments:** Information gathering tools include 3 parts:

**Part 1:** demographic data (age, gender, occupation, educational level, address, phone number) and information related to surgery (date of admission, date of surgery, medical diagnosis and indication of surgery).

**Part 2:** the assessment of the outcomes of postoperative THA by WOMAC scale (24 questionnaires) [8]. Scoring is based on three manifestations: pain, stiffness, physical function. It probes the dimensions of pain (5 items), stiffness (2 items), and physical function (17 items). All the items are scored on a scale of 0 - 4 (0= none, 1= slight, 2= moderate, 3= very, 4= extremely), and lower scores indicate superior function; higher scores indicate lower level of function and values are summed up for a combined WOMAC score. The WOMAC index score is used to determine the level of function: < 35: high function, = 35: mean, and > 35: low function.

**Part 3:** the Short-form (36 questions) of health survey (SF-36) version 2 [9] is a measurement model 36 items and covers eight domains (physical functioning (PF), physical role (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), emotional role (RE) and mental health (MH)) and two summary scales on physical component score (PCS) and mental component score (MCS). The scores for the SF-36 domains range from 0 (worst health) to 100 (best health), with higher scores indicating better health status. The SF-36 index score is used to determine the level of quality of life: < 30: poor quality of life, 30- 80: moderate quality of life, and > 80: good quality of life. We chose WOMAC and SF-36 scale because they are relative simplicity and easily to administer and score. Both of them are used and applied commonly in many studies and

easily understand for participants. Moreover, they made easier to analyse data and have the high responsive outcomes, only a small sample size is required for statistical calculations [10,11].

**Data collection process:** Patients were admitted to hospital one day before operation, after they were fully informed about their operation by both the surgeon and nurses, patients who consented to participate were asked to complete questionnaires. **Information gathering technique:** all patients who met inclusion were invited and explained the importance to participate in the study. After filling the informed consent, data collection was conducted with using structured questionnaires in Vietnamese. The questionnaires collected data concerning general information (demographic data and medical history), WOMAC and SF-36 scale. The data was collected before surgery and at 3 months of operation, we contacted patients to obtain information to assess outcomes of THA surgery. Patients answered the questionnaires by verbally communicate and write. We observed the process that patients completed and explained any problems that were difficult to understand. Recheck all of patients' information; someone answered lack of information, we returned the patients' rooms or called them to add more information. Participant questionnaires were marked with ordinal numbers.

## Results

### Demographic characteristics of the participants

In 41 patients of this study, the age of the participants ranged from 37 years old to 74 years old with mean age was 53.78 years (SD= 8.95). Table 1 illustrates the age of subjects according to 5 groups. The rate of male and female was 78.05%, 21.95%, respectively. Most of participants were in the 50 to 60 age group, 48.78%; the lowest rate of the age group was 7.32% (3 participants were less than 40 years old). The participants were mostly manual workers 87.80%. The number of participants who graduated in secondary school accounted for the highest (48.78%) (Table 2).

**Table 1:** Demographic characteristics of the participants.

Demographic characteristics		N	%
Gender	Male	32	78.05
	Female	9	21.95
Age	< 40	3	7.32
	40-50	10	24.39
	51-60	20	48.78
	61-70	6	14.63
	> 70	2	4.88
Occupation	Manual worker	36	87.8
	Educator/officer	2	4.88
	Retired	3	7.32
Educational level	Primary school	4	9.76
	Secondary school	20	48.76
	High school	13	31.7
	University, college	4	9.76

## Clinical characteristics of the study participants

In the consideration of medical characteristics, the study showed the rate of participants with THA surgery due to femoral head necrosis and hip OA, 87.8%, 12.2%, respectively. The number of side surgeries was 53.66% participants with right THA and 46.34% participants with left THA surgery.

## Outcomes of the study participants with THA surgery following SF-36 scale

In preoperative, 100% participants had poor quality of life and all patients reached good quality of health post-operatively (Table 3). The observed mean scores of eight subscales of SF-36 scale changed significantly in 3-month post-operative (Table 4). The average mean of role-physical and role-emotional scales was 100 after 3 months of THA surgery.

## Comparison of scores after THA in the low function and high function groups

In preoperatively, all subscales' scores of WOMAC scale, including pain, stiffness, and physical scale and SF-36 physical functioning in low function group were worse than patients in high function groups. The rate of participants with normal scores of SF-36 physical functioning and WOMAC subscales

increased postoperatively. At 3-month post-operative, there was significant difference for all changes from baseline of WOMAC scale and SF-36 physical functioning in low and high function groups.

## Discussion

### Demographic characteristics of the study participants

The mean age of the study participants was  $53.78 \pm 8.95$  years. The result was similar to the study of Pham Ngoc An and Nguyen Tan An with the average of age  $52.7 \pm 9.21$  and ranged from 32 years old to 69 years old to assess initial outcomes of 39 patients with non-cement THA surgery [12]. This result was different to a study of Singh et al., and Xie et al. The difference could result from data selection and sample size. The percentage of male and female was significant difference, including 78.05% male and 21.95% female in our study. The number of male was higher than female [7] in THA surgery. The result could result in male people abuse alcohol, cigarette or manual labour jobs. There are 80.48 % participants graduated from secondary school and high school. The rate of participants graduated from primary school and university or college was 9.76%. This result indicates the educational level of group of patients in this study is quite low that can affect to the perception and understanding of patients about issues related to disease and surgery, leading to affect to preoperative emotional status of patients as more stress and anxiety, and affecting on postoperative outcome directly [13,14]. The number of participants with employment was the highest rate, accounted for 87.7%. There are 3 retired participants (7.32%). There are only 2 (4.88%) participants working as officer. This may explain that people who are employments (worker, farmer, manual worker) are more likely to suffer from THA.

### Clinical characteristics of the study participants

In this study, there were 41 patients and investigated the two diagnoses of THA surgery (Table 1). There were 87.8% participants underlying diagnosis of FHN. The percentage of participants with THA surgery due to OA of the hip was 12.2%. The result of Singh et al (2017) conducted 47,523 primary THA cases, including 95.2% OA, and 4.8% FHN. The difference may result from our study performed in short period with small sample. The occurrence of TLHA and TRHA surgery was 46.34% and 53.66%, respectively. The result was similar to a study of Pham Van Long, Pham Phuoc Tho [12]. The result could explain that THA surgery can occur in both sides.

### Outcomes of the study participants with THA surgery following SF-36 scale

In this 3-month prospective study, THA surgery was effective in terms of improvement in health-related quality-of-life dimensions with 100% patients had good health following SF-36 scale (Table 3). The mean of SF-36 physical functioning score increased from 14.75 to 85.88 (Table 4). The difference was statistically significant ( $p < 0.05$ ). The results revealed that the lowest preoperative mean scores were in RE and RP, but they were the highest scores postoperatively.

**Table 2:** Demographic characteristics of the participants.

Clinical characteristics		N	%
Medical diagnosis	Femoral head necrosis	36	87,8
	Hip osteoarthritis	5	12,2
Surgery indication	Total left hip arthroplasty (TLHA)	19	46,34
	Total right hip arthroplasty (TRHA)	22	53,66

**Table 3:** Outcomes of the participants with THA surgery following SF-36 scale.

SF-36	Preoperative		3-month postoperative	
	N	%	N	%
Poor quality of life	41	100	0	0
Moderate quality of life	0	0	0	0
Good quality	0	0	41	100

**Table 4:** Outcomes of the participants at 3-month operative THA surgery.

SF-36 scale	Per-operative (Mean $\pm$ SD)	Per-operative (Mean $\pm$ SD)	P
PF	14.75 $\pm$ 14.0	85.88 $\pm$ 6.68	<0.05
RP	0	100	<0.05
BP	29.32 $\pm$ 16.52	92.62 $\pm$ 9.11	<0.05
GH	15.48 $\pm$ 14.3	79.51 $\pm$ 11.11	<0.05
VT	32.19 $\pm$ 21.91	84.39 $\pm$ 6.99	<0.05
RE	0	100	<0.05
SF	20.42 $\pm$ 18.27	95.73 $\pm$ 7.18	<0.05
MH	38.14 $\pm$ 18.67	86.34 $\pm$ 6.38	<0.05
PCS	13.51 $\pm$ 9.96	88.00 $\pm$ 4.97	<0.05
MCS	26.61 $\pm$ 13.84	90.05 $\pm$ 4.16	<0.05
SF-36	18.52 $\pm$ 10.06	88.90 $\pm$ 4.18	<0.05

It may result from SF-36 mental functioning score is more sensitive and specific to THA outcomes than SF-36 physical functioning score and the physical functioning takes more time for recovery after surgery [15]. The mean score at preoperative and 3-month postoperative was 29.32 and 92.62, respectively for BP ( $p < 0.05$ ). General health's mean score changed significantly at 3 months and increased from 15.48 to 79.51 ( $p < 0.05$ ). The mean score at 3 months were 84.39, 95.73, and 86.34 for VT, SF, and MH, respectively. There was a significant difference ( $p < 0.05$ ). It means that all patients with THA surgery had substantial improvement about pain reduction and regain physical function at 3-month after surgery [16]. The result of de Araújo Loures and Leite (2012) was quiet similar to our results. The difference between our study and previous study [17,18] in SF-36 subscales was due to the sample size and indication of a surgeon at 3-month postoperatively.

### Comparison of test scores after total hip arthroplasty in the low function and high function groups

This study was observed in the SF-36 and WOMAC scale showed that the outcomes of patients with THA surgery had statistically significant improvements in both low function and high function groups without demographic characteristics. According to studies [17,19] indicated that outcome of participants with THA surgery was not affected by age, gender and different surgical techniques. The result of studies found comorbidities and education had little effect to outcome of patient after THA surgery [19,20]. In this study, the number of study participants in both groups compared was limited. Nevertheless, evaluating after THR surgery by SF-36 and WOMAC scales [10,11] have the high responsive outcome, only a small sample size is required for statistical calculations. There were significant differences in WOMAC pain, WOMAC physical and SF-36 physical functioning in low function and high function groups preoperatively ( $p < 0.05$ ) (Tables 5, 5.2.). At 3-month post-operative, all of patients had better scores. WOMAC physical functioning and WOMAC stiffness, the differences were not statistically significant differences ( $p < 0.05$ ). In low function group, the mean scores of change from baseline for WOMAC physical functioning, stiffness, pain and SF-36 physical functioning at 3-month postoperatively were better than in high function group ( $p < 0.05$ ). It means that all patients with THA surgery in low function and high function reduced pain, restored disability hip, and had substantial improvement of quality of life at 3-month postoperatively following modern perioperative management, protocols and surgical techniques. However, the low function group had more improvement those in high function group follow THA surgery [5,13]. This study conducted in 2 orthopaedic departments and all patients were operated by only one experienced surgeon. That allowed for standardization about protocol, surgery procedure and prostheses. In addition, the proportion of normal number patients between low and high function group was 20.38%, and 23.53%, respectively for WOMAC physical functioning. Therefore, it may explain the trend of outcome in low function group was catching up with the high function group after 3 months of THA surgery. The outcomes of THA surgery are excellent quality regardless the

level of physical function before operation. The percentage of normal number scores for WOMAC physical function between low and high function at 2 years follow-up was 84.8%, and 85.1%, respectively in the study conducted by Alzahrani [7]. At postoperative 3 months of operation, following the indication of a surgeon, some of questionnaires were not entered in this study. In addition, our study only performed 3-month postoperatively. That's why both the proportion of normal number scores for WOMAC physical and SF-36 physical functioning after 3 months of operation were less than result of Alzahrani and the mean scores of change from baseline at 3-month postoperative in this study were more than the result of the study of Alzahrani [7]. In 2016, Alzahrani [7] conducted a study to assess the outcome of primary THA surgery due to OA in high and low functioning patients following WOMAC scale (Table 6). The study is conducted in 2 specific departments and had one surgeon and was divided into 2 function group following WOMAC score. This study also concluded that the low

**Table 5.1:** Comparison of test scores after THA in the low function and high function groups.

Instruments	Low function (n=24)	High function (n=17)	P-Value Low versus high
<b>WOMAC physical function score</b>			
Per-operative (mean±SD)	59.45±4.52	22.76±1.60	<0.5
Post-operative (mean±SD)	1.91±1.28	1.52±1.17	0.16
Change from baseline(mean±SD)	-57.54±4.5	-21.23±2.22	<0.05
Number of normal scores preoperatively (%)	0	0	---
Number of normal scores at 3 months (%)	20.83	23.53	0.56
<b>WOMAC pain score</b>			
Per-operative (mean±SD)	16.75±2.15	9±1.11	<0.05
Post-operative (mean±SD)	0.75±0.79	0.29±0.46	<0.05
Change from baseline(mean±SD)	-16±2.12	-8.70±0.84	<0.05
Number of normal scores preoperatively (%)	0		
Number of normal scores at 3 months (%)	70.59	41.67	
<b>WOMAC stiffness</b>			
Per-operative (mean±SD)	6.08±1.41	2.70±0.58	<0.05
Post-operative (mean±SD)	0.50±0.78	0.35±0.60	0.65
Change from baseline(mean±SD)	-5.58±1.28	-2.35±0.78	<0.05
Number of normal scores preoperatively (%)	0	0	---
Number of normal scores at 3 months preoperatively (%)	66.67	70.59	0.79

**Table 5.2:** Comparison of test scores after THA in the low function and high function groups.

SF-36 Physical functioning	6.51±4.44	22.37±6.54	<0.05
Per-operative (Mean ± SD)	86.63±5.02	89.93±4.31	<0.05
Post-operative (Mean ± SD)	80.11±6.23	66.56±5.51	<0.05
Change from baseline (Mean ± SD)	0	0	---
Number of normal scores preoperatively (%)	58.33	76.47	0.22
Number of normal scores at 3 months (%)			

SD: Standard Deviation.



**Table 6:** Outcomes of patients with THA surgery at HMUH and SPH.

Scales	Preoperative			3-month postoperative		
	HMUH (n=9) Mean $\pm$ SD	SPH (n=32) Mean $\pm$ SD	P - value Mean $\pm$ SD	HMUH (n=9) Mean $\pm$ SD	SPH (n=32) Mean $\pm$ SD	P - value Mean $\pm$ SD
<b>SF-36-scale</b>						
PCS	21.19 $\pm$ 12.17	11.35 $\pm$ 8.23	0.003	88.67 $\pm$ 5.57	87.81 $\pm$ 4.86	0.32
MCS	46.00 $\pm$ 14.62	22.11 $\pm$ 10.67	0.001	91.23 $\pm$ 4.75	89.72 $\pm$ 4.00	0.17
SF-36 score	29.63 $\pm$ 11.49	15.40 $\pm$ 7.13	0.002	89.79 $\pm$ 4.79	88.65 $\pm$ 4.04	0.24
<b>WOMAC scale</b>						
Pain	10.89 $\pm$ 4.04	14.28 $\pm$ 4.07	0.01	0.56 $\pm$ 1.01	0.56 $\pm$ 0.62	0.52
Physical functioning	38.22 $\pm$ 17.77	45.94 $\pm$ 18.81	0.28	2.44 $\pm$ 1.60	2.75 $\pm$ 1.48	0.3
Stiffness	3.78 $\pm$ 2.54	3.38 $\pm$ 2.24	0.6	0.33 $\pm$ 0.5	0.47 $\pm$ 0.76	0.86

SD: Standard Deviation.

function group can catch up the high function group. Alzahrani evaluated those patients during 2 years after surgery, and recognised that the number of patients with normal score at WOMAC subscales and SF-12 physical functioning was similar in both low and high function group. Limitation of our study was performed over short-term flow-up. The result of a study of Fortin et al indicated that patients were operated THA later in the natural of functional decline of hip joint had worse functional status post- operatively [5,6]. Fortin et al., also showed that the low function group had more improvement than high function group after six months of THA surgery and revealed that the low function group never catch up the high function group. However, the study of Fortin et al conducted in two hospitals in two different countries, which leads to the difference about patient education, care process, rehabilitation and activity restrictions.

## Conclusion

Total hip arthroplasty surgery significantly improves patient health and well-being. Preoperative pain or worse physical function cannot predict outcome of patient with THA surgery or ability to regain normal physical function. The outcomes of THA surgery are excellent quality regardless the level of physical function before operation. The outcomes of THA surgery are excellent quality regardless the level of physical function before operation. That can support surgeon and nurses consult effectively and make patient less anxiety. All patients are able to regain normal healthy physical function. However, our study has some limitations. The sample size was relatively small and had restrictions during 3 months postoperatively. Therefore, it may not reflect all patients who may not be included in the study population, which is a limitation of this study. Bias may occur when convenience sample was collected.

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